

Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

In the Matter of

Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650  
MHz Band

GN Docket No. 12-354  
**COMMENTS OF HKT Limited**

---

HKT Limited (HKT) is Hong Kong's premier telecommunications service provider serving the Hong Kong public and local and international businesses with a wide range of telecommunications services. As a member of the PCCW Group (who owns UK Broadband LTD), HKT was separately listed on the Hong Kong stock exchange in November 2011. HKT is a member of the Global TD-LTE Initiative (GTI) and have interest in LTE Band 42 and 43.

HKT hereby submits its comments in response to the *Further Notice of Proposed Rulemaking and Order* (the "FNPRM") in the above-captioned proceeding of the Federal Communications Commission ("Commission").

## **1 Introduction**

On December 12, 2012 the Commission issued a Notice of Proposed Rulemaking ("NPRM"), under GT Docket 12-354, proposing the creation of a new Citizens Broadband Radio Service ("CBRS") sharing the 3550-3650 MHz band with incumbent users. In the NPRM, the Commission also sought comment on a supplemental proposal to include the adjacent 3650-3700 MHz band in the proposed regulatory regime to create 150 MHz of contiguous spectrum for CBRS. On April 23, 2014 the Commission issued a Further Notice of Proposed Rulemaking ("FNPRM"), under GT Docket 12-354 seeking further comments.

As a mobile operator HKT has wishes to encourage a healthy ecosystem for 3GPP<sup>1</sup> TD-LTE equipment and devices capable of operation in 3GPP LTE Bands 42 and 43 (as shown in Figure 1). Consequently HKT have an interest in the proposed CBRS and the associated rules detailed in the FNPRM which

---

<sup>1</sup> <http://www.3gpp.org/>

apply to the 3550-3650MHz band and potentially, after a transition period to the 3650-3700MHz band.

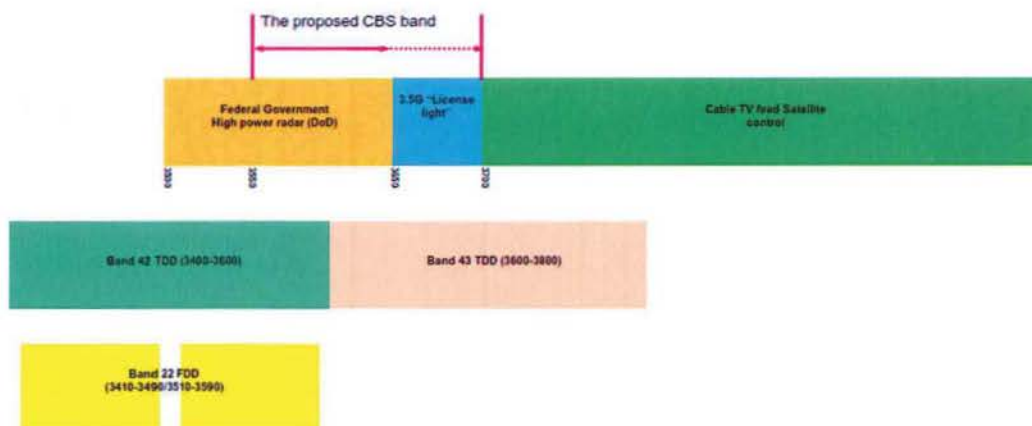


Figure 1 3GPP TD LTE Bands 42 and 43 within the context of the FCC proposals

Presented below are HKT's comments relating to the FNPRM which we trust will receive due consideration.

## 2 Summary

HKT is encouraged and pleased to see progress towards wider use of 3.5GHz spectrum in the USA. We agree that this spectrum has an important part to play in relieving spectrum scarcity and the FCC's drive to address wireless coverage and capacity issues. The importance of and need to protect incumbent spectrum users is understood as is the desire to innovate with regard to spectrum sharing. However, we implore the FCC to consider how this innovation can embrace International Standards that are the basis of services already provided in the 3.5GHz band by operators worldwide.

In doing so HKT urge deeper consideration of:

- I. The needs of licensees in the United States already using the 3650-3750MHz band (primarily WiMAX users).
- II. The rapid global trend of migration from WiMAX to 3GPP LTE / LTE-Advanced and in particular the growth of new TD-LTE networks in the band.
- III. The lack of dynamic spectrum access functionality in existing 3GPP standards and the need for them if the aims of the Spectrum Access System ("SAS") proposed by the FNPRM (Subpart F) are to be achieved.

The concept of a licensing regime that protects incumbent users and permits Priority Access Licensing ("PAL") licensee protection from GAA users is supported (FPRM Para 41). However, HKT argue that the PAL scheme proposed is not in the best interests of United States consumers, manufacturers and existing licensees. Further it is not in the interests of 3.5GHz licensed operators

and equipment vendors as the approach is contrary to that used in the existing and growing 3.5GHz ecosystem. This argument is based on:

- I. The need to support SAS functionality (FPRM Par 43). This is not consistent with current or proposed WiMAX or 3GPP standards.
- II. The use of SAS implies that a PAL licensee may be required to reduce power output or desist from transmission entirely should the SAS dynamic channel allocation mechanism determine that a neighbouring license has priority. This will affect an operator's ability to guarantee service and could be a disincentive to invest in network roll-out.
- III. The combination of small granular (census tract) licensing areas (FPRM Para 44) and short, annual licensing term (FPRM Para 49) is likely to be a disincentive to invest capital in equipment and deployment in the US and globally.

Moreover, HKT considers that some guaranteed fixed channel spectrum should be licensed for longer term use across wider geographies particularly for use with small cell deployments to the benefit of US consumers. Such licenses would not require this use of SAS but would be restricted in terms of geography and power output to protect incumbents. Additionally, like incumbents, these licenses would be protected against interference caused by the proposed GAA and PAL users due to their use of SAS the database of which would reflect a licensee's fixed allocation.

Evidence and rationale for HKT's position is provided in the following sections.

### **3 International allocation of the 3.5/3.6GHz bands**

Since the WRC-07 meeting in 2007, International Telecommunications Union members have agreed to allocate 3400-3700MHz across all three ITU regions to mobile or IMT<sup>2</sup> use. This allocation agreement covers most countries of the world as stated in radio regulations (RR) 5.430A, 5.431A, 5.432B and 5.433A. Current regulations resulting from WRC-12 allocate 3400-4200MHz to mobile use. It is expected that deeper global agreement to use bands in this range for IMT use will be an outcome of ITU-R WRC-15 in 2015.

Furthermore, on December 9, 2011 the 48 pan-European member countries<sup>3</sup> of the CEPT/ECC passed the ECC Decision (11)06 resolution (amended March 14, 2014)<sup>4</sup> harmonising arrangements for 3400-3800MHz across the wider European continent. This decision designates this spectrum to mobile/fixed communications networks (MFCN) with TDD the preferred duplex mode for 3400-3600MHz and compulsory for 3600-3800MHz.

---

<sup>2</sup> The term IMT covers IMT-2000 (e.g. LTE & WiMAX 802.16e) and IMT-Advanced systems (e.g. LTE-Advanced & WiMAX 802.16m)

<sup>3</sup> <http://www.cept.org/cept/membership-and-observers>

<sup>4</sup> <http://www.erodocdb.dk/docs/doc98/official/pdf/ECCDec1106.pdf>



### 3.1 ITU spectrum allocation implication

Where IMT use is allocated by ITU radio regulation the use of IMT technology is specified, which in the case of IMT-Advanced encompasses WiMAX 802.16m and LTE-Advanced. Consequently equipment vendors and operators worldwide have focussed their efforts on these and their parent technologies (802.16d, 802.16e and LTE).

## 4 International Standards

The dominant standards for equipment used in these bands are IEEE WiMAX 802.16d and 802.16e and 3GPP LTE and LTE-Advanced. Whilst roll-out of WiMAX based equipment continues, WiMAX standards development and adoption of 802.16m has slowed as LTE and LTE-Advanced traction has increased. The 3GPP has formally sanctioned 3.4-3.8GHz bands for use. Since 2011 the TDD bands (42 & 43) have been included. Relevant bands defined for LTE-Advanced Rel-10 (TS 36.101)<sup>5</sup> are (as shown in Figure 2):

LTE Band	Duplex method	Frequency Allocation
42	TDD	3400 – 3600 MHz
43	TDD	3600 – 3800 MHz
22	FDD	3490 MHz UL / 3510 – 3590 MHz DL

Figure 2: LTE Advanced Rel-10 bands between 3.4 and 3.8GHz

### 4.1 Lack of dynamic spectrum access in current standards

Current releases of the WiMAX and LTE-Advanced specifications assume unencumbered use of spectrum with at best interference coordination features as part of the technology implementation. Dynamic spectrum access by the means described in the FPRM Spectrum Access System is not a part of the specification. Research into dynamic spectrum success for LTE-Advanced is the topic of academic study<sup>6 7</sup> but to date a 3GPP agreed scheme for dynamic spectrum access has not emerged.

## 5 3.5/3.6GHz deployments

Globally 3.5/3.6GHz bands have been deployed by over 100 operators globally. Many of these operators have deployed WiMAX in the past but are increasingly migrating to TD-LTE.

In the United States WiMAX 802.16d and 802.16e is heavily used in the 3650-3700 MHz band which since 2005 has been available under a light licensing regime. The NPRM (Paragraph 29) reported

<sup>5</sup> <http://www.3gpp.org/DynaReport/36101.htm>

<sup>6</sup> Deaton, Juan D., Ryan E. Irwin, and Luiz A. DaSilva. "Dynamic spectrum access in LTE-advanced networks." *Physical Communication* 10 (2014): 127-143.

<sup>7</sup> Osa, Vicente, et al. "Implementing opportunistic spectrum access in LTE-advanced." *EURASIP Journal on Wireless Communications and Networking* 2012.1 (2012): 1-17.

that as of October 2012 there were 2,117 licensees with more than 25,000 registered sites throughout the United States using 3650-3700 MHz band.

With regard to TD-LTE deployments, there is an increasing momentum around 3.5/3.6GHz with over twenty commercial contracts awarded of late as shown in Figure 3.

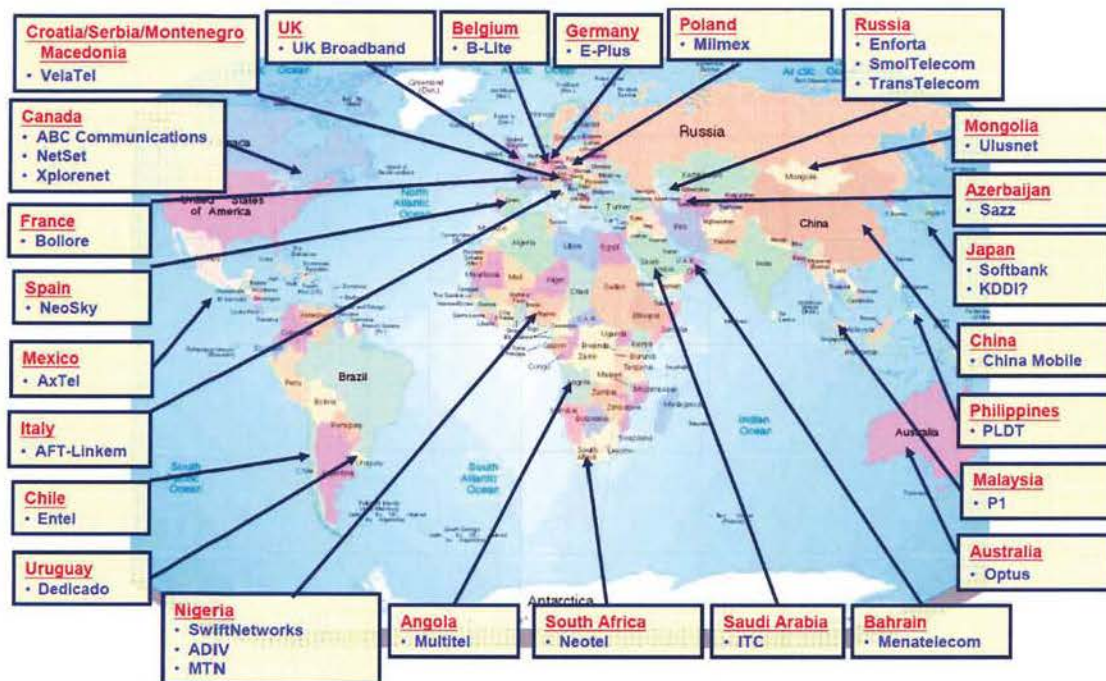


Figure 3: Recent TD-LTE contracts at 3.5/3.6GHz (Source: Global TD-LTE Initiative)

## 6 Global trends in the 3.5/3.6 GHz band

Deployment of mature WiMAX 802.16e continues but as TD-LTE grows chipset vendors, equipment vendors and operators are migrating from WiMAX to TD-LTE or building new TD-LTE networks.

3.5GHz TD-LTE equipment and end users devices are available from multiple vendors with some chipsets offering software only upgrade from WiMAX to TD-LTE. The August 2013, Innovation Observatory's 3.5/3.6GHz LTE TDD Ecosystem Report<sup>8</sup> identified availability of 16 end user devices for use in Bands 42 and 43. This same report forecasts that shipment of 3.5GHz capable devices will be between 5-15% of global device shipments (see Figure 3).

<sup>8</sup> <http://www.lte-tdd.org/d/file/Resources/pub/2013-11-22/4989a6d1b9ed435fa6ec20f5d291f547.pdf>



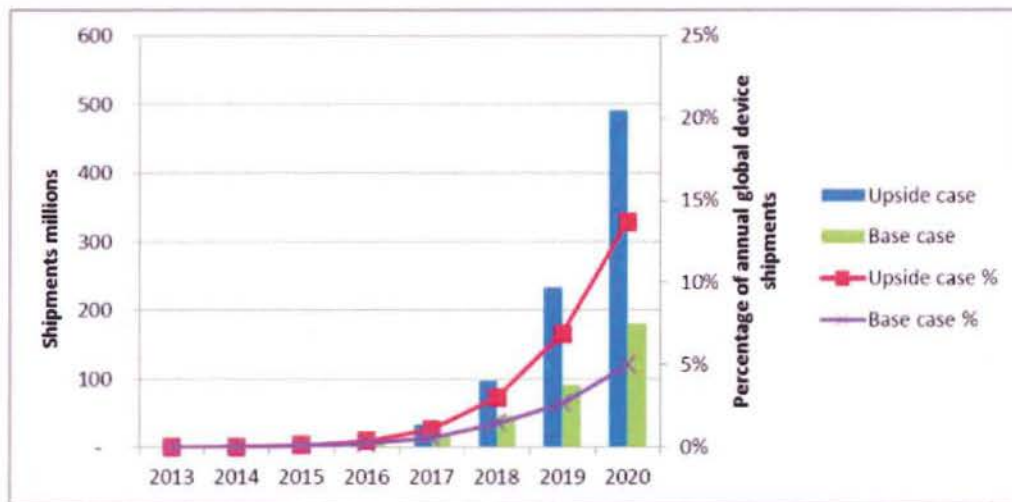


Figure 4 Forecast of 3.5GHz device shipments (Source: Innovation observatory)

The FNPRM (Para. 1 & 12) acknowledges and encourages the use of 3.5GHz for small cells. We believe this is a highly likely use case exemplified by early small cell deployments (for example Airspan<sup>9</sup>) and device chipset vendors such as Qualcomm who see 3.4 to 3.8GHz emerging as a new small cell band.



Figure 5: TD LTE 3.4 to 3.8GHz Emerging as a new small cell band. Source: Qualcomm<sup>10</sup>

To ensure continued rapid growth of solutions in this band it is important that vendors are able to develop products that meet globally agreed standards and interoperability arrangements. We are

<sup>9</sup> <http://www.airspan.com/2014/01/30/airspan-and-b%E2%80%A2lite-successfully-deploying-lte/>

<sup>10</sup> <http://www.qualcomm.com/media/documents/files/lte-tdd-the-global-solution-for-unpaired-spectrum.pdf>

concerned that the novel approach to spectrum sharing proposed by the FNPRM is counter to this imperative and hence make the suggestion that some guaranteed fixed channel spectrum should be made available protected, as incumbents will be, by SAS used by SAS compliant GAA and PAL users.

Furthermore, licensed small cell deployment well away from exclusion zones would be simpler more deterministic and arguably more reliable if licensing was achieved without the need for SAS across the whole 150MHz of spectrum. This combined with the security of license tenure that extends well beyond a year would be beneficial to US consumers and no doubt a preferable approach for network operators such as Verizon, Sprint, T-Mobile and AT&T.

## **7 International Roaming**

The requirements of international roaming are not considered within the FNPRM. This concerns us for two reasons. Firstly, in the case of UE / base station compatibility and secondly potential UE PHY damage from harmful interference.

### **7.1 UE and eNodeB compatibility**

Outside of the US there is no requirement to implement SAS. In the best case a 3.5GHz UE being brought from e.g. Europe would not be able to connect to a proposed US SAS compliant base station but would not transmit, avoiding harmful interference to other spectrum users. However, in the case of an LTE compliant UE and eNodeB, arrangements would need to be made to make sure that a registering UE listening to RRC System Information from an eNodeB would remain quiet and not send RRC connection requests that will interfere with other users.

Implementing this and the required elements of SAS signalling implies a change to 3GPP LTE specifications or equipment incompatibility.

We urge further consultation and 3GPP standardisation in this respect.

### **7.2 Potential UE PHY damage from harmful interference**

US Naval radar is reportedly capable of producing highly directional RF beams with radiated power measured in GW. ITU-R Recommendation M.1465-1<sup>11</sup> gives the characteristics for radar in this band. Table 1 of this recommendation states a peak Tx antenna input power of up to 6400kW with an antenna gain of 42dBi. This implies a peak radiated power of over 60GW.

It is unclear to HKT if the effects of such powerful pulses on the PHY electronics have been considered. Could a UE tuned in the band to listen for a base station be destroyed if it was close to such naval radar? Would devices from Europe or other regions exposed to such pulses survive?

---

<sup>11</sup> [http://www.itu.int/dms\\_pubrec/itu-r/rec/m/R-REC-M.1465-1-200703-!!!PDF-E.pdf](http://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.1465-1-200703-!!!PDF-E.pdf) Table 1

## 8 Conclusion

HKT is supportive of the wider use of 3.5GHz in the USA but urge further consideration of the rules outlined in the FNPRM . In particular:

- I. Current use and needs of existing light license users in the 3650-3750MHz (mainly WiMAX) need to be adequately addressed. The current could potentially require equipment replacement in a relatively short timescale.
- II. There is wide global agreement through the ITU that IMT-Advanced, which in practice means 3GPP LTE-Advanced, is the technology for use in this band. With CEPT's backing TD-LTE looks set to dominate the band in Europe and elsewhere.
- III. Use of standards based 3GPP TD-LTE at 3.4-3.8GHz is growing rapidly. Today 3GPP standards do not incorporate dynamic spectrum access. We urge further consultation and standardisation through the 3GPP prior to implementation of SAS based spectrum sharing.
- IV. Allocation of some guaranteed fixed channel spectrum to operators would add certainty and encourage further development of the existing ecosystem based on TD-LTE. This could work alongside the SAS based approach.
- V. Development of devices that can operate globally makes sense for consumers, US and non-domestic equipment vendors. Further consultation is needed if international roaming is to succeed.

HKT wishes to thank the FCC for consideration of the matters raised.

For and on behalf of HKT Limited:

Name	Role
Paul Berriman	Group Chief Technology Officer
Signature	
Date	14 July 2014